U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF PLANT INDUSTRY—Circular No. 110.

B. T. GALLOWAY, Chief of Bureau.

MISCELLANEOUS PAPERS.

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BUREAU OF PLANT INDUSTRY.

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GRASS DEMONSTRATIONS IN THE SOUTH.[1]

The accompanying correspondence, dealing with the subject of demonstrations in grass culture, is submitted as showing the interest in this kind of work in South Carolina. It is published by direction of the Honorable Secretary, who for years has advocated the production of grass and legumes as a step toward greater diversification of crops and the increase of animal husbandry in the Southern States.

MEMORANDUM FOR THE SECRETARY.

DEAR MR. SECRETARY: You may be interested in the efforts being made to encourage the production of grass as a feature of stock raising in South Carolina. Last spring Mr. W. W. Long, of our Farmers' Cooperative Demonstration Work, inaugurated a series of demonstrations in portions of the Piedmont region to show the possibilities of grass and hay production. He took up the work with 100 different farmers, inducing each of them to make an acre demonstration with grass. The predominant industry of this section is cotton raising and not a great deal of interest is taken in live stock. Each farmer put out an acre of grass under the direction of Mr. Long. The land was thoroughly plowed, a ton of lime to the acre was applied, and, in addition, 400 pounds of fertilizer used. The fertilizer consisted of 200 pounds of acid phosphate and 200 pounds of ground bone. The acid phosphate cost $12 a ton and the ground bone $29 a ton, which would make the cost of the 400 pounds of fertilizer $4.10. The lime cost about $5 a ton. The farmers furnished all the work, the lime, and the fertilizer. The grass seed was furnished from cooperative funds. The most successful mixture for hay in this section of the South is found to be one made of orchard grass, tall meadow oat-grass, Italian rye-grass, and red clover. A half bushel each of orchard grass, tall meadow oat-grass, and Italian rye-grass, and 10 pounds of red-clover seed were sown to the acre. This very heavy seeding was believed to be necessary in order to insure a good stand. We have been using this mixture for some time on the Arlington Experimental Farm with good success, cutting as high as 2½ and 3 tons of hay to the acre.

The work in South Carolina has been very satisfactory, practically all of the 100 farmers having a fine crop of hay this season. From all indications, some of these plats will cut 2½ to 4 tons per acre. So much interest has been aroused in the matter that farmers are now preparing to put out 2 additional acres, making 3 acres in all. They have found by this demonstration that they can grow enough hay

[1] Issued Jan. 18, 1913.

to take care of the two or three head of horses used in their general farm work. The success with the hay crop has encouraged farmers, furthermore, to look into the live-stock proposition to the end of introducing greater diversification and devoting less acreage to cotton.

Very respectfully,

B. T. Galloway,
Chief of Bureau.

April 28, 1912.

MEMORANDUM FOR THE SECRETARY.

Dear Mr. Secretary: You will probably recall that last spring we sent you a memorandum concerning some important demonstration work in South Carolina by Mr. Long, who is connected with this Bureau under Mr. Knapp. Mr. Long started out with the plan of demonstrating to the farmers of South Carolina the practicability of growing grass. About 100 good farmers were selected and each agreed to put out an acre of grass under Mr. Long's direction. In the memorandum which I forwarded you the success of the work at that time was indicated. As a result of further work a great deal of interest has been aroused in the subject. Mr. Long informs me that 300 demonstration plats have been put out this fall.

Recently Hon. A. F. Lever made a trip over the State in company with Mr. Long, and I inclose herewith a copy of a letter which Mr. Lever has forwarded; also a copy of a letter which he wrote to Prof. English, of Clemson College, both of which are self-explanatory.

Very respectfully,

B. T. Galloway,
Chief of Bureau.

November 25, 1912.

[Inclosure.]

Prof. B. T. Galloway,
Washington, D. C.

Dear Dr. Galloway: I am inclosing herewith a copy of a letter which I have written to-day to Prof. English, of Clemson College, which explains itself. I have expressed to him what I desire you to know as my feeling in regard to this grass-demonstration work now being conducted in this State. I do not believe that I shall have any hesitation in saying that the Department is undertaking no greater work than this is, and I sincerely trust that the funds set aside for this work for this season will be sufficient to enable it to develop as rapidly as possible. I desire to talk with you about it when I come on to Washington.

I regret that you could not be with us on the trip, as I know that you would have enjoyed it.

With personal regards, I am, very truly,

A. F. Lever,
Member of Congress from South Carolina.

Lexington, S. C., *November 22, 1912.*

[Inclosure.]

Prof. W. L. English,
Clemson College, S. C.

My Dear Prof. English: You will recall seeing Mr. Long, Mr. Dorrick, and me starting on our trip to look at the grass demonstrations being conducted by the Department of Agriculture in 20 of the counties of this State. I have become so much interested in the work and feel that it is of so much importance to the future of the State that I felt that I should call your attention to it that you in turn might bring the work to the notice of those in authority at Clemson.

The demonstration plats in the upper part of Richland County have been growing for one year, and not only do they strike a layman, such as I, as having been entirely successful, but the demonstrators themselves are enthusiastic over the results obtained and are proving it by the fact that they are increasing their acreage, and their neighbors are following their example.

The plat of Mr. Sam C. Cathcart, a few miles above Winnsboro, was particularly successful, for that gentleman told me that he had gathered 3 tons of first-class hay from a little less than an acre of ground and that he valued it at about $33 per ton, that being the price of good timothy hay at Winnsboro. Mr. Cathcart is not only a large farmer, but runs a considerable-sized dairy, and he tells me that in this grass work of the Department he sees the beginning of the solution of the agricultural problems of this State as far as forage crops are concerned and as far as soil building goes.

From our Fairfield trip we came back into the Dutch Fork of Lexington County and saw there the plat of Dr. J. L. Shuler, one of the most substantial citizens of the State; and not only could we see with our own eyes that it had been entirely successful, but Dr. Shuler assured us that it was successful beyond his expectations, and as a result he has doubled his acreage this year. Mr. James W. Shealy, who is in charge of this section of the county, informs me that his 3 acres of experimental work for this past season has been increased to 17 for the coming season, which, in my mind, is evidence not only of the success of the demonstrations, but of the interest of the people in it, who are beginning to realize that they must grow more in connection with cotton. We came back into the territory covered by our mutual friend, Judge Derrick, and saw two of his demonstrations, one on the farm of Mr. G. W. Caughman and one on that of Mr. D. J. Caughman. The former has his demonstration plat upon about as poor a piece of red Spanish oak land as you ever saw, and notwithstanding this he got from it 2 tons of fine hay. Mr. D. J. Caughman has his plat on better land, and yet not the best type of land by any means, and he tells me that he cut his grass three times and gathered 3 tons to the acre. He is now grazing his hogs upon it, and the clover is 6 or 8 inches high and practically green. The cured hay is as fine as I ever saw.

What I have seen on this trip convinced me that my own idea of the feasibility of growing grasses in this country, formed some 10 years ago, was entirely correct. We can grow grasses without any doubt, and it is up to the Department of Agriculture and Clemson College workers to lock arms and demonstrate that fact to the farmers of the State. To my mind there can be no line of work undertaken that will mean so much ultimately to the wealth of the State as to induce our farmers to grow their own forage crops; and this, as you know, is unequaled as a soil builder and conservator. I think every student of the agricultural future of this State is agreed upon the proposition that we must make ourselves, to as large an extent as possible, a live-stock State. We must grow cattle; we must have some substantial crop with which to reenforce our cotton crop; we must have some way of reducing the enormous fertilizer bills of the State. We must find some means of producing enough beef and dairy products in this State to save us the enormous drain because of our deficiency in this respect; and, to my mind, this grass work, if we can make it successful, and I am sure it can be made successful with the proper efforts behind it, will bring about the very condition of affairs which, I think you will agree, is so necessary to the agriculture of the State.

I have taken the liberty of writing you at this length because of my very deep interest in this work and because of the impression I formed of you personally of your great desire to be of the greatest benefit to the people of the State.

With personal regards, I am, very truly,

A. F. Lever.

Lexington, S. C., *November 22, 1912.*

[Cir. 110]

SOME ASIATIC ACTINIDIAS.[1]

By David Fairchild, *Agricultural Explorer in Charge of Foreign Seed and Plant Introduction.*

ACTINIDIA ARGUTA.

At least five species of Actinidia are now growing in this country, and they deserve much more consideration than has been given them. There is no finer climbing shrub for porches in this latitude than *Actinidia arguta* Miq. Its foliage seems to be practically free from diseases, is of a beautiful dark-green color with reddish midribs, and for situations where a mass of uncontrolled irregular foliage is wanted and when a trellis can be provided, it is unusually successful. It is a very vigorous grower and will cover a trellis 20 feet long and 10 feet high in two or three years.

Several years ago the writer had the pleasure of tasting a few fruits picked from a vine of this species which covered over a hundred feet of trellis on the house of Mr. Charles N. Parker, of Marblehead, Mass. This vine had fruited more or less regularly since it was 9 years old, and it was at that time 20 years of age. The flavor of the fruits was very sweet and pleasant, reminding one of figs. They were about the size of damson plums, with very thin skins and filled with extremely small seeds. A woodcut of the fruit of this species has been published in Bailey's Cyclopedia of American Horticulture.

The value of this plant as a fruiting vine seems to have been little emphasized in America. The long time required for it to come into bearing and its dicœcious nature, which has no doubt resulted in many males being planted, has probably disheartened Americans from growing it more extensively. From Asia, however, there have come various reports about its usefulness and productiveness which make it seem probable that there are better fruiting strains there than we have in America. In northern Chosen (Korea) Mr. J. D. Hubbard, of the Oriental Consolidated Mining Co., of Unsa, informed the writer in 1909 that this species was known there as the tara, or wild fig, and that it climbed 30 feet high and fruited profusely.

ACTINIDIA CALLOSA.

The species *Actinidia callosa* Lindl. is allied to *A. arguta* and probably has not been grown outside of arboretums and botanic gardens in America.

[1] Issued Jan. 18, 1913.

ACTINIDIA POLYGAMA.

In the Arnold Arboretum, vines of *Actinidia polygama* Miq. have been growing successfully for years, and from one point of view, at least, it is one of the most interesting plants in the arboretum. Its leaves and twigs are so relished by cats that a wire cage has been constructed about it, and evidently they still molest it, for wherever the twigs or leaves come near enough to the wire netting they are scratched and mutilated by the cats and cats' hairs are sticking to the wires, which are evidences of efforts to get at the plants. Mr. Jackson Dawson's observations indicate that the Boston cats learned that this was good to eat a few months after it was first introduced.

ACTINIDIA KALOMIKTA.

Actinidia kalomikta Ruprecht, which has also proved hardy in Boston, although so far as known it has not fruited, is reported to fruit well in the mountains near Merkoechofka, Siberia. The fruits are dried by the Russian settlers and put aside for winter use in the making of confectionery and to put in their bread. Mr. Frank N. Meyer has described a variety of this species from Tungying, China, which is shorter and shrubbier than the ordinary one. He found the same species indigenous in the mountains of Okyansky in eastern Siberia. In the mountains of northern Chosen (Korea), where he saw it in August, 1906, he reported it to be a scant bearer.

ACTINIDIA CHINENSIS.

The most striking species of this interesting genus yet brought into America is *Actinidia chinensis* Planch., known in China as the yang-taw, and it is of very recent introduction. The attention of English horticulturists was first called to it by Mr. Robert Fortune, who found it when traveling in behalf of the Royal Horticultural Society. Mr. E. H. Wilson was the first to send seeds of it to Veitch & Sons, in London, from his first expedition to western China. As early as 1900 seeds were sent to the Office of Foreign Seed and Plant Introduction from Ichang, but they failed to grow. In 1904, however, the office received through the initiative of Consul General L. S. Wilcox, of Hankow, a shipment of plants which had been carefully packed at Chungking by Mr. E. H. Wilson, at that time engaged in an exploration of Szechwan Province. The shipment arrived in excellent condition, and as it is from these plants that the distributions through the Southern States have been made, sufficient historical interest attaches to it to warrant publishing Mr. Wilcox's letter in full.

[No. 115.]

Hon. Francis B. Loomis,

Assistant Secretary of State, Washington, D. C.

Sir: I have the honor to inform you that last fall I obtained a sample of fruit called by the Chinese "yang-taw." On investigation I learned that the original plants were brought by Mr. Wilson, a botanist of Kew Gardens, London, from near the borders of Yunnan in the foothills in the southern part of the province of Szechwan (a climate similar to southern California). He sent some of the plants to England, where they endeavored to introduce them, but found the climate unsuitable, being too cold, except those that were planted in the Kew Gardens. The latter have proved a success. The botanical name given them at Kew Gardens is *Actinidia chinensis*. The fruit is about the size of a hen's egg, has a thin, leathery, hairy skin covering it, and is full of meat; seeds very similar to a gooseberry or fig. It is sometimes called the hill gooseberry. In bloom it has a beautiful flower, and in my opinion it belongs to the same family as the passion flower. When the fruits are picked and left for a few days until soft they are very fine eating. They have the flavor of the gooseberry, fig, and citron. They make delicious jam, pies, and sauce.

I asked Capt. Lovett, the Chinese Imperial Maritime Customs' Harbormaster here, if it was possible to procure a few plants, as I would like to send them to the United States Department of Agriculture. We supposed they had come from Ichang and would be like currant shoots. He wrote to the party that sent the fruit (Mr. Goodhart, of Ichang) who said he would try. After giving up all idea of receiving them, a box came two days ago, weighing three or four hundred pounds, with the information that they had been secured at Chungking (1,000 miles up river), from plants formerly obtained on the borders of Yunnan by Mr. Wilson, under whose advice they have been packed in moss and sand, warranted to keep for months. I felt I had a white elephant on my hands; the bill for them has not yet been presented. I have inquired of several southerners and none of them are acquainted with the fruit in the South, and it certainly would be a valuable fruit to introduce there. I think it worth the cost and trouble of sending it. I will forward it to Shanghai and request Consul General Goodnow to have it transferred to a Japanese steamer to Consul Harris, of Nagasaki, and have requested him to put it on a transport for San Francisco, in care of Mr. William A. Cooper, U. S. Despatch Agent, to hold it pending instructions from the State Department as to where he is to ship it. I will also write Mr. Cooper to inform the State Department of its arrival. I have packed in the box two bottles of the fruit that I put up in alcohol last fall in order that the Agricultural Department may get some idea of the two varieties that I received. The long variety seems to be the finer flavored.

As the plants are carefully packed and strongly boxed, I trust that they may arrive in good condition and that the fruit may be more valuable for family use than the navel orange. At least I trust it will not be the case of a "mountain bringing forth a mouse."

I have the honor to be, sir, your obedient servant,

L. S. Wilcox,
Consul General.

Hankow, China, *March 21, 1904.*

At the Plant Introduction Field Station at Chico, Cal., these plants have flowered (Pl. I) and have been propagated. Since 1904 the Office of Foreign Seed and Plant Introduction has sent out 1,340 young plants of this remarkable climber, and one of these flowered in 1910 at Durham, N. C. Unfortunately, however, the specimens which flowered at Chico turned out to be males, and therefore the plants

propagated and distributed are valuable only as ornamentals. Our subsequent introductions of seedling plants have not as yet given any indication of flowering. Doubtless there are females among them. Repeated efforts to get authentic female plants of good varieties from China have been unsuccessful, owing to the difficulty of getting living plants properly packed and shipped from the interior. In the Gardeners' Chronicle for July 31, 1909, is an account of the first flowering of this species in Europe. The flowers borne in 1909 at Nice, France, were also all males. It is therefore too early to predict anything as to the probable behavior and value of the species from the fruit-culture point of view.

Reports have reached us that a specimen of this species has fruited at Veitch & Sons' nurseries, near London, but no details have yet been published, so far as the writer is aware, regarding the quality of this fruit borne in England.

These facts are much to be regretted, since from Mr. Wilson's descriptions the fruit must be excellent. In his report of 1898 he describes the plant as "fruiting abundantly, bearing fruits 1 to 2½ inches long and 1 to 1¾ inches across (Pl. II). Epicarp membranous, russet brown, more or less clothed with villous hairs. Flesh green, of most excellent flavor, to my palate akin to that of the common gooseberry but tempered with a flavor peculiarly its own." [1]

Dr. Samuel Cochran, of Hope Hospital, Hwaiyuan, Anhwei, China, in a letter dated September 26, 1911, writes:

> We find them delicious; they have something of the tart, rich flavor of the gooseberry or strawberry. Not that the flavor is the same, but it has the same attractiveness, being entirely free from mawkishness or insipidity. They make excellent preserves. The flavor scarcely needs improvement. The fruit eats well raw after the skin is removed, needing about as much sugar as strawberries.

Rev. William F. Beaman, of Kiatingfu, near Yachow, has reported orally to the writer that the flavor of this fruit varies remarkably, some tasting like a pineapple and others like a strawberry, confirming in this respect the experience of Mr. Leigh Hunt respecting the Korean species (probably *Actinidia arguta*). According to Mr. Hunt, who spent many years in northern Chosen (Korea), one could find on the same vine fruits of a flavor to suit everyone's taste.

Others have written enthusiastically of this fruit, and photographs and alcoholic specimens show it to be one worthy of consideration. The behavior of the plant solely as a climber warrants its wide distribution, however, and it has already been taken up by at least one American nursery firm. This species is not so hardy as the others mentioned, being killed to the ground by severe freezes, but the rapidity of its growth in the spring and the interesting character

[1] Wilson, E. H. *In* Seeds and plants imported during the period from January 1 to March 31, 1908: Inventory No. 14. U. S. Department of Agriculture, Bureau of Plant Industry, Bulletin 137, p. 14, No. 21781, 1909.

PLATE I.

VINE OF THE YANG-TAW IN BLOOM.

This vine was introduced from Yunnan, China, in 1904. It is the first of the plants to bloom in America, but unfortunately it has proved to be a male. Photographed at the Plant Introduction Field Station at Chico, Cal., where the vine has made a rank growth and where it has bloomed repeatedly.

A PLATE OF YANG-TAW FRUITS.

One of at least two distinct strains of *Actinidia chinensis* Planch. which have been observed in China. Photographed by Mr. E. H. Wilson at Chiutingshan, western Szechwan, China, October 27, 1908. Enlarged to natural size.

of its rapidly growing shoots will make it a desirable plant for trellises and porches far north of the region where it can pass the winters uninjured (fig. 1). The remarkable plushlike texture of the leaves, their unusual dark-green color, the bright-pink hairiness of the young shoots, and the regular spacing of the leaves on the stem all contrib-

FIG. 1.—The yang-taw on a wall trellis. Shoots produced before the middle of July by a vine of *Actinidia chinensis* Planch. which was killed to the ground by a temperature of —17° F. the previous winter. Before autumn the trellis was almost concealed by the foliage. The trellis is on the north side of the house, and the spaces of the trellis are 10 inches square. Photographed at "In the Woods," Chevy Chase, Md., July 28, 1912.

ute to make this climber especially suited to locations where broad masses of green foliage are wanted. An old wall or outhouse, a broad porch or pergola, where the plant is not confined, would be a suitable place for this attractive vine. The Chico specimens have flowered profusely. The male flowers, which are borne in masses, are single white blossoms as large as a wild rose and with a

great quantity of yellow stamens (fig. 2). The petals fade to a pink as they wither. The flowers have a delicate but peculiar fragrance.

Considering the wide range of climate to which the different species of this genus of Asiatic plants is adapted, from the climate of California to that of Maine, the thought has occurred to the writer

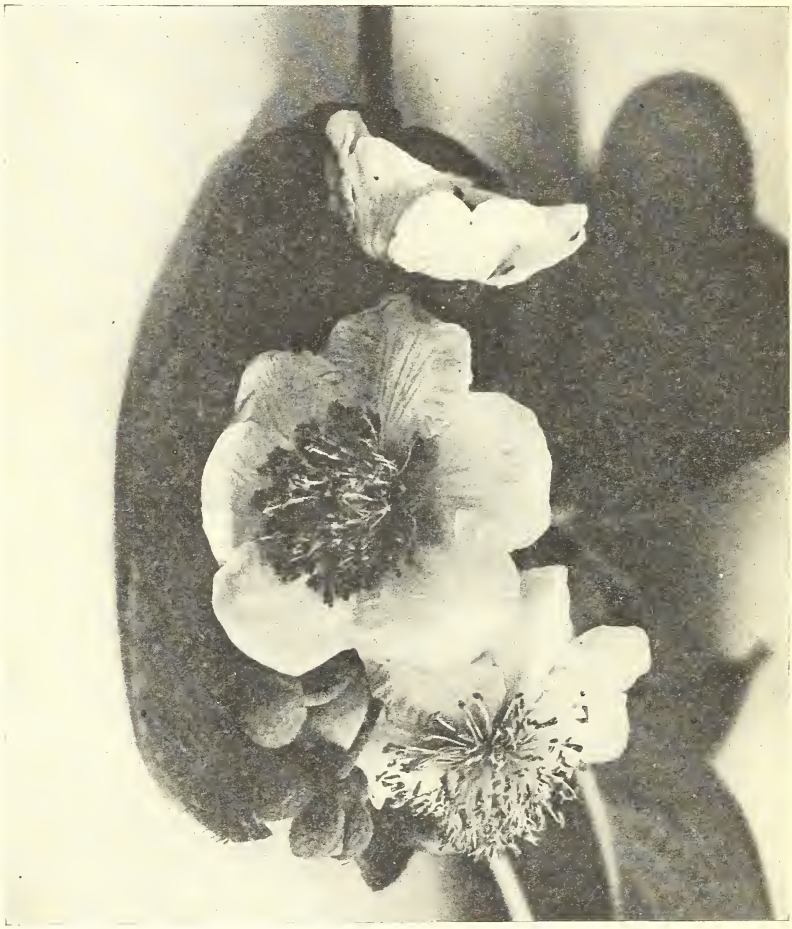

FIG. 2.—Male flowers of the yang-taw. The flowers are pure white when they open but turn pink as they fade. The stamens are bright yellow. Natural-size photograph taken of flowers borne by the original introduction of the species (*Actinidia chinensis* Planch.) into America (S. P. I. No. 11629) at the Plant Introduction Field Station, Chico, Cal., by Dr. Walter Van Fleet, April 18, 1910.

that the genus ought to be a promising one for the hybridizer to work with. Whether the pollen of male plants of *Actinidia chinensis* in California can be kept long enough to pollinate the female flowers of *A. arguta* in Massachusetts can be easily determined, and, if not, the cultivation of the different species side by side in regions where both will flower is a possibility.

POWDERY DRY-ROT OF THE POTATO.[1]

By W. A. Orton, *Pathologist in Charge of Cotton and Truck Disease and Sugar-Plant Investigations.*

INTRODUCTION.

In recent years a new potato disease, which has been named the "powdery dry-rot," has come to the front. It has caused heavy losses in several Western States from Minnesota to Washington and is a special menace to those irrigated districts where the potato is one of the main money crops and where the product must be shipped many hundreds of miles to reach a market. Several instances have recently occurred where carloads of potatoes were shipped from the Northwest to Texas points and to Chicago. Leaving their point of origin in apparent good order they arrived at their destination badly decayed, were rejected by the purchasers, and had to be consigned to the dump. The cause of this rapid deterioration was the powdery dry-rot. Such experiences are exceedingly harmful to the reputation of a new potato district. Buyers will not erect warehouses or provide shipping facilities for a permanent trade, nor will they purchase for distant shipment save at the producers' risk. It is therefore imperative that the growers take every possible means to prevent the spread of this disease.

DESCRIPTION OF POWDERY DRY-ROT.

This disease is an external dry-rot. It may start at any point on the outside of the tuber or gain entrance at the stem end. It starts most readily in wounded potatoes, but may spread to uninjured ones. The spots are wrinkled, discolored, and somewhat sunken, externally darker brown than the normal epidermis, internally sepia brown, with a dark, discolored layer next the sound flesh. In the later stages the decayed portions become dry and powdery, with internal cavities filled with fungous mycelium.

The cause of powdery dry-rot is a newly described fungus, *Fusarium trichothecioides* Wollenw.[2]

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[1] Issued Jan. 18, 1913.

[2] Jamieson, C. O., and Wollenweber, H. W. An external dry-rot of potato tubers caused by Fusarium trichothecioides Wollenw. Journal, Washington Academy of Sciences, v. 2, no. 6, p. 146–152, Mar. 19, 1912.

The disease is still too new and our experience too limited to permit positive statements relative to means of control, but the following advice is based on what is known of the life history of the causal fungus.

POSSIBLE MEANS OF CONTROL.

Clean seed.—The powdery dry-rot is a storage trouble and appears not to begin work till after the harvest, yet there is evidence that land becomes infected through planting diseased seed potatoes and that this contagion is carried over until fall and communicated to the new crop. Consequently the most rigid inspection of the seed planted is advised. No potatoes with a trace of decay should go into the ground. All the seed stock should be disinfected by soaking for two hours in a solution of 1 pint of formaldehyde in 30 gallons of water. This will also kill the germs of potato scab.

Rotation of crops.—Rotation is necessary for the permanent success of potato culture in any country, and particularly in irrigated districts. While it is possible to produce two or three successive crops on new land, it is unwise to attempt it on account of the disease factor. One potato crop in three years has been proved too short a rotation in many districts. One in five may serve the purpose in our Western States. If a field has produced potatoes affected by powdery dry-rot, it is especially desirable to rotate before planting potatoes there again.

The storage problem.—Most important of all for the control of dry-rot is the method of handling the potatoes after digging and during storage, as it is probably here that the main fault lies.

Well-built storage cellars are a necessity from an economic standpoint, to enable the grower to await better prices and to properly assort and pack his crop. In such cellars, if properly built, ventilated, and wtached, the greatest immunity from decay may be insured.

These storage houses should be thoroughly cleaned at the end of the season, all old potatoes and débris carried out, and the walls and floors washed with a disinfectant like copper sulphate (blue vitriol), using a 1 per cent solution, or corrosive sublimate, using 2 ounces to 16 gallons of water.

The greatest losses that have been brought to our attention have occurred in that portion of the crop which was not put in storage or shipped direct from the field to the market, but held for some weeks after having been dug and sacked. Such potatoes, stored in sacks in large piles and subjected to variable and occasionally rather high temperatures, offer most favorable conditions for the development of the dry-rot fungus.

It is suggested that, when it is necessary to hold potatoes for a time before shipping and it is not feasible to put them into a good, cool storage cellar, the experiment be tried of leaving them unsacked in the field in long, low piles or ricks, covered with sufficient earth to protect them from sun and frost, and that they be sent from these piles to market with as little intervening delay as practicable.

It is perhaps hardly necessary to warn growers that the dry-rot parasite attacks most readily bruised or wounded potatoes and that care in digging and handling, to leave them with nature's protecting skin intact, is a great insurance against loss.

PREPARATION OF LAND FOR EGYPTIAN COTTON IN THE SALT RIVER VALLEY, ARIZONA.[1]

By E. W. Hudson, *Assistant in Arboriculture, Crop Physiology and Breeding Investigations.*

INTRODUCTION.

The Department of Agriculture has from time to time during the past year sent out circular letters to the Egyptian cotton growers in the Salt River Valley; calling their attention to various phases of cotton culture and offering suggestions in handling the crop.

The harvest of the Egyptian cotton crop of 1912 grown in the Salt River Valley is so nearly completed that the growers who have taken good care of their crop are confident of a yield of from 600 to 700 pounds of lint per acre. Owing to the success of the present crop, the growers are planning to increase their acreage and a number of the farmers throughout the valley are planning to plant on a large scale. From the present indications it is safe to estimate that from two to three thousand acres of Egyptian cotton will be planted in the valley in 1913.

SELECTION OF LAND.

Since it is very important that the land be prepared as early as possible in the winter, it is well for those who are planning to plant to give some thought at this time to the selection and preparation of their fields. To secure the best crop of Egyptian cotton, it is of very great importance that the grower select uniform land with very slight grade on which alfalfa has grown for at least three years.

The amount of fall or grade in the land is of great importance to the cotton crop. To produce the best crop the land should be almost level. In many instances where alfalfa is plowed up it is advisable to irrigate in a different direction to secure a lighter grade. Land with a slight grade will require less water for the crop and will irrigate more evenly and produce a more uniform cotton. If there is much grade to the land it will be found that the fields dry out in spots during August and September, and in order to avoid injury to the quality of the cotton it will be necessary to irrigate these spots separately, thus causing much extra work.

[1] Issued Jan. 18, 1913.

The question of the soil best adapted for cotton has been raised many times. Any land that will grow good crops of alfalfa and grain will also grow good cotton. The heavier class of soil will as a rule grow a smaller and more fruitful plant with shorter nodes, and hence more numerous fruiting branches. While some raw land will make good cotton, it has been clearly demonstrated that land previously in alfalfa will produce a higher grade of cotton and the crop can be produced more economically, for new land as a rule requires more frequent irrigations and it will be found necessary to irrigate in spots owing to the uneven way it will take water.

A great deal of the best land in the Salt River Valley is overrun with Bermuda and Johnson grasses. The badly infested area comprises much of the land that was under cultivation prior to the completion of the Roosevelt Dam. There are, conservatively speaking, fully 10,000 acres of land on the south side of the river alone that would be greatly benefited by cotton. This is the best land for cotton in the valley, since most of it is level and rich from previous crops of alfalfa.

PREPARATION OF THE LAND.

In preparing this land for cotton the best plan would be to plow about 2 inches deep during August, allowing the soil to dry out thoroughly. This should be followed by thorough disking and harrowing, using a long-tooth harrow and dragging as many of the roots to the surface as possible. A spring-tooth harrow might be used to advantage in this work. During November or December the land should again be given a shallow plowing and pulverized by disking and harrowing.

At this time it would be well to plow the land both ways with an orchard cultivator or similar tool with long teeth. This work will bring a great many of the roots to the surface, and if in sufficient quantity they should be raked up and burned or hauled off the field. The land may then lie fallow until the latter part of February, when borders should be thrown up about 2 rods apart. Just before planting time, which is between March 10 and April 1, the land should be flooded and then disked and harrowed until in perfect tilth. At this time, if the soil is a very heavy clay, in some instances it may be advisable to throw up beds from 4 to 4½ feet wide and 8 inches high, with the idea of dragging off fully half of this height before planting. A drag can be easily constructed of 2 by 4 inch or 2 by 6 inch scantling that will take two or possibly three beds at a time. It should be weighted down until it drags off enough of the surface clods to get down to the moist soil. If a lighter soil is used it will not be necessary to throw up beds. It is advisable to bed some classes of heavy soil because it may be necessary to irrigate in order to germinate the seed,

whereas a lighter soil may be pulverized sufficiently after a thorough irrigation to hold enough moisture to germinate the seed without further irrigation. Only as much land should be irrigated at one time as can be prepared and planted before becoming too dry to germinate the seed.

Seed must always be planted in moist soil. The seed may be drilled in with a cotton planter, which will plant either one or two rows. This may be either a one or two horse machine. If a single-row walking planter is used it may be necessary to mark out the rows on the bed before planting in order to keep the planter on the bed.

PREPARING BERMUDA AND JOHNSON GRASS LANDS.

While it may cost the grower from $8 to $10 an acre to put Bermuda and Johnson grass land in shape for cotton, by intensive cultivation during the first season the grass can be kept down, although it may be found necessary to chop it out in the rows at the time the cotton is being thinned. Bermuda grass alone is not so hard to eradicate as Johnson grass or a mixture of Johnson and Bermuda grasses.

It is possible by shallow plowing during November or December, followed by thorough disking and harrowing, to put Bermuda-grass land in shape for cotton. If the land is kept thoroughly disked and harrowed during the winter the freezing will greatly aid in killing the roots. Two or three weeks before planting the land should be plowed from 4 to 6 inches deep and thoroughly pulverized. If regular cultivation be kept up during the early part of the growing season or until the cotton plants become large enough to shade the ground, the Bermuda grass will not have a chance to establish itself enough to become a nuisance. By such culture it is believed to be possible for the growers to eradicate the grass entirely within two or three years, growing a remunerative crop on the land.

PREPARING ALFALFA LAND.

In preparing for cotton alfalfa land which is not overrun with Bermuda or Johnson grass the same general plan could be followed. However, it will not be necessary to do as much disking and harrowing or cross plowing as in the case of land infested with Bermuda and Johnson grass. If alfalfa land is plowed 2 inches deep and turned up to the sun until thoroughly dried and then later in the season plowed 4 to 6 inches deep there will be very little trouble caused by alfalfa during the following season. Alfalfa land may be prepared any time prior to the planting season, but the best results will be obtained if the land is plowed first in October or November, followed by a second plowing in January.

PREPARING COTTON OR GRAIN LAND.

In preparing cotton land for again planting to cotton a stalk cutter should be used to chop the stems into small pieces; then the land should be plowed, disked, and harrowed until in perfect tilth, when it may be left until planting time. In the absence of a stalk cutter the plants can be dragged down with a heavy drag after a hard freeze. A great many of the stalks will be pulled out, and those remaining in the ground must be dug up with a mattock. This operation is inexpensive, costing only $1 or $1.25 per acre. After all the plants are pulled out of the ground the field should be raked crosswise with a hayrake and the stalks put into windrows, where they can be easily burned.

Land previously in cotton or grain if irrigated before plowing can be put in perfect condition with one plowing. Land previously in alfalfa should be plowed twice. Last year one farmer plowed his land and leveled it very poorly, and instead of disking several times after the irrigation just before planting the seed made small furrows and planted the seed with the idea of pulverizing the land when cultivating. This piece of cotton had to be hoed twice and cultivated several times more than a near-by field which was double disked and harrowed until it was in perfect condition before the seed was planted. A farmer planting cotton will make a very great mistake if he does not thoroughly prepare his land before planting the seed. It depends upon the kind of soil and the condition it is in whether a double plowing is necessary to put the land in good tilth or whether this can be done with a single plowing and double disking and double harrowing. No amount of labor within reason expended during the winter in preparing the seed bed will be regretted, since if this is thoroughly done a great deal less work during the summer will be required to grow the crop, and the yield will be correspondingly better.

AGRICULTURE ON THE TRUCKEE-CARSON PROJECT.[1]

VEGETABLES FOR THE HOME GARDEN.

By F. B. Headley, *Superintendent*, and Vincent Fulkerson, *Scientific Assistant*, *Western Irrigation Agriculture.*

INTRODUCTION.

The notes on vegetables presented in this circular embody the results of trials for three years on the Truckee-Carson Experiment Farm. Cultural directions have been given only in part. Most farmers have some knowledge of the growing of vegetables, and it is therefore only the special or little-known methods that are suggested here.

Many of the common vegetables are so easily grown on the Truckee-Carson Project that every farmer should set aside enough land for a vegetable garden, where sufficient produce can be raised to supply the family throughout the season.

Among the most easily grown vegetables are asparagus, beans, beets, carrots, cucumbers, eggplants, kohl-rabi, lettuce, muskmelons, onions, peas, peppers, potatoes, pumpkins, radishes, squashes, tomatoes, turnips, and watermelons.

A well-kept vegetable garden on the farm is one means of lessening the cost of living, and during the summer it provides a large variety of foods that a farmer could not otherwise afford, and even during the winter, if proper care be taken to preserve them.

Asparagus, beans, cucumbers, peas, pumpkins, squashes, beets, and tomatoes may be put up in glass jars and preserved satisfactorily.[2] Winter muskmelons, pumpkins, squashes, and many of the root crops can be kept by storing them in pits or cellars.

CULTURAL DIRECTIONS.

Asparagus.—This is a perennial crop and should therefore be planted in some portion of the garden where it will not interfere with the easy cultivation and growing of other crops. The best method of starting an asparagus bed is by planting 1-year-old roots,

[1] Issued Jan. 18, 1913.

[2] See Farmers' Bulletin 359, entitled "Canning vegetables in the home."

but the plants may also be grown from seed. A very fertile soil is essential and the crop should therefore be manured heavily each year. It is better not to harvest the asparagus the first two seasons after planting, for it is necessary that a strong root system be developed. Commencing with the third year, harvesting may begin. Asparagus will grow in soils too alkaline for most other crops.

Beans.—As beans are tender annuals, they must be planted after danger of frost is past, which on the Truckee-Carson Project is about May 15. Over 20 varieties have been tried at the experiment farm in comparative tests. As the result of these tests the following varieties are recommended for home use:

Bush varieties of string beans, green podded:
- Early Yellow Six Weeks.
- Burpee's Stringless.

Bush varieties of string beans, wax podded:
- Improved Golden Wax.
- Dwarf Horticultural.
- Davis White Wax.

Pole varieties of string beans:
- Kentucky Wonder Pole.

Field varieties for dry shelled beans:
- Colorado Mexican.
- Navy.
- Mexican Pinto.

Beets.—Beets are of easy culture and will grow in soil containing considerable salt. The subsoil should be loose and mellow, as a hardpan tends to cause the roots to grow short and misshapen, with many side roots. A late planting may be made between June 20 and July 15 for autumn and winter use. For fall planting a turnip-shaped variety rather than a long-shaped, slow-growing variety should be selected.

Carrots.—Carrots are somewhat more difficult to grow than beets. The seeds are small and slow to germinate, so that it is important to have a mellow, well-tilled soil—one that does not "bake" or crust badly. Sometimes seeds of quick-maturing radishes are mixed with the carrot seeds. The radish seeds, being relatively large and quick germinating, break the crust and make it easy for the tender carrot seedlings to come through. The soil for the carrots should be loose and mellow, as a hardpan subsoil tends to make them grow short, misshapen, and much branched. A late planting may be made during the last half of June for autumn and winter use.

Corn.—Sweet corn does not usually produce well on desert soils, but it grows well on old alfalfa land. The greatest difficulty in connection with the growing of sweet corn is due to the prevalence of the corn earworm, for which no effective remedy is known. It is essential that early varieties be selected. Peep o' Day, Golden Bantham, and Early Minnesota are good varieties to use.

Cucumbers.—As cucumbers are sensitive to frost they must be planted after danger of frost is past, unless arrangements are made

for covering and protecting them. They transplant with difficulty, and it is therefore usual to plant the seed in the hills where they are to grow. This crop is easily grown and does well on most soils of the Truckee-Carson Project. The heaviest yielding and most satisfactory varieties tried so far at the experiment farm are the Early Frame, Long Green, Early Russian, and White Spine. The Gherkin is a small, productive, prickly variety, useful only for pickling purposes.

Kohl-rabi.—This vegetable has been on trial at the experiment farm for three years and has always given good results. The flavor of kohl-rabi is between that of a turnip and a cabbage. It is necessary to use this vegetable while it is growing and tender, as when it is fully matured it is likely to be tough and stringy. The culture is the same as for turnips. Unharvested plants need not be destroyed in the summer when they have become too tough for use, for if they are left in the ground until fall a second growth takes place, new bulbs growing out of the old ones. This growth is as sweet and tender as the spring growth.

Melons.—Watermelons are easily grown and are very productive in most of the soils of the project. As the growing season is short, only the earliest maturing varieties should be planted. Those which have given best satisfaction at the experiment farm are the Kleckley Sweet, Kentucky Wonder, Chilean, and Rocky Ford.

Muskmelons, like watermelons, are easily grown, especially on the lighter soils of the project. Winter varieties, such as the Khiva, Winter Pineapple, and Kriss Kringle, may be successfully grown. These varieties, when stored in a cool place, will keep well into the winter, so the farmer may have muskmelons on his table for Christmas and New Year's Day. Desirable early-maturing summer varieties are the Rocky Ford, Fordhook, and Extra-Early Hackensack. Both watermelons and muskmelons may be planted in the field before the danger of frost is past if boxes, gunny sacks, straw, or some other suitable means of protection are thrown over them on cold nights.

Onions.—On some of the better soils of the Truckee-Carson Project onions are grown commercially and a yield of 10 to 20 or more tons per acre obtained. It would not be advisable to attempt to grow them commercially on new land. Local onion growers have found it advisable to plant the seed very early in the spring, before April 1, so as to allow the plants to become well established before the dry, hot weather begins. Good varieties to plant for the home garden are the Yellow Globe Danvers, Red Wethersfield, and Prize Taker.

Peanuts.—Peanuts have been grown for several years, but satisfactory yields have not been obtained. The small Spanish peanuts matured earlier and yielded better than the Mammoth Virginia peanuts. Peanuts can not be recommended for general planting.

Peas.—Peas usually produce a good crop in the gardens over the project, but sometimes fail in raw or alkaline soils. The Champion of England and the Alaska were the best-yielding varieties tried at the experiment farm in 1912. The seed should be planted very early in the spring.

Potatoes.—Potato growing [1] is one of the recognized agricultural industries of Nevada. Potatoes are best grown on river-bottom land, tule land, or old alfalfa land. They do not always grow well on the raw desert soils, which are deficient in humus and likely to contain harmful quantities of alkali salts. The varieties which have given best results at the experiment farm are the White Beauty, Burbank, Triumph, Mammoth Pearl, Peachblow, and Early Ohio. A variety test was conducted in 1911 by Wallace Ferguson in cooperation with the experiment farm. Eight varieties were included in the test. The three heaviest yielding varieties were the White Beauty, Mammoth Pearl, and Rose Seedling.

Pumpkins and squashes.—Pumpkins and squashes should be grown in every farmer's garden, as they are prolific and are valuable for table use. Any overproduction can be profitably fed to dairy cows or hogs. Good varieties of pumpkins for table use are the Japanese Pie, Small Sugar, and Cushaw. They are sweet and fine grained. The large varieties, such as the Mammoth King and Connecticut Field, are heavy producers, but they do not have the fine flavor and quality for cooking of those mentioned above.

The most desirable summer squashes tried are the Yellow Summer Crookneck [2] and White Bush Scallop, and the most desirable winter varieties tried are the Warted Hubbard and Delicious. The Mammoth Chile was the heaviest yielding variety, but its quality is not good for cooking purposes.

Tomatoes.—Tomato seed should be sown about April 15 in boxes or hotbeds, so as to have good-sized plants by the time danger of frost is past. The growing season is so short that an early start is essential. Tomatoes usually produce satisfactory crops, but they are subject to a disease known as the wilt (*Fusarium* sp.). This disease attacks the individual plants in the tomato patch. The first indication is a wilting of the leaves of the affected plants. The wilt becomes more noticeable from day to day, until it finally causes the death of the plants. No remedy is known, but damage from the disease can be reduced by growing the plants on soil that has not recently produced tomatoes. As the wilt is infectious, all diseased plants should be pulled and burned as soon as they become affected.

[1] For the culture of the potato, see Farmers' Bulletin 386, entitled "Potato culture on irrigated farms of the West;" or "Nevada potatoes," by C. A. Norcross, Nevada Bureau of Industry, Agriculture, and Irrigation, Bulletin 6, 1912.

[2] Also known as the Golden Summer Crookneck.

Good varieties are Early Jewel, Dwarf Champion, New Stone, New Coreless, New Globe, and Golden Queen. After frost has killed the vines the larger green tomatoes may be picked, each wrapped in a piece of newspaper, packed in a shallow box and left to ripen by storing in a closet or other suitable place where there is no danger of freezing. By doing this, farmers may have ripe tomatoes up to Thanksgiving time.

Turnips and rutabagas.—Turnips seeded in April are usable late in June or early in July, but soon become woody and bitter. Rutabagas are ready for use by the middle of July. For winter use rutabagas should be seeded in June and turnips in early July. If seeded earlier than this they become woody in the late fall. When the greater part of the growth takes place in the cool weather of autumn the quality is better and the size larger.

Wonderberry and garden huckleberry.—The fruit of the wonderberry is fairly agreeable when eaten raw, but is used chiefly in the making of pies and jams. The vines are usually heavily loaded, but the fruit is so small that it is somewhat difficult to gather. The plant is an annual, but reseeds itself, so that volunteer plants come up in the garden each year.

The garden huckleberry is advertised by some seedsmen as being the same as the wonderberry, but the two plants are very different. The garden huckleberry is an upright-growing, bushy plant, while the wonderberry is decumbent. The fruit of the garden huckleberry is two or three times as large as that of the wonderberry and when raw is disagreeable to the taste. It must be cooked to be palatable. After cooking there is practically no difference in flavor between the two fruits. These two fruits do not deserve to be extensively grown, but under conditions on the Truckee-Carson Project they are sufficiently valuable to deserve a place in the family garden, at least until the more desirable small fruits have come into bearing.

FUNGOUS STAINING OF COTTON FIBERS.[1]

By Albert Mann, *Plant Morphologist, Agricultural Technology and Cotton Standardization and Grading Investigations.*

OCCURRENCE OF THE DEFECT.

The manufacturers of certain grades of cotton fabrics are occasionally annoyed by the appearance of bright-red or deep purple-blue threads appearing in white cotton cloth, thereby greatly lowering its commercial value. The number of such threads in a square yard is extremely small, but the brilliant colors make these threads very prominent.

The American Cotton Yarn Co. has sent to the Office of Agricultural Technology and Cotton Standardization and Grading Investigations two sets of manufactured samples showing these defects, with a request for information as to the cause. Inquiry makes it practically certain that the fibers are not colored in the process of manufacture. Careful microscopical examination of the colored fibers gave no indication of bacteria or of fungous growth. The colors were very resistant to alkalis of moderate strength, as well as to bleaching agents.

PROBABLE DISCOVERY OF THE CAUSE.

Recently a boll of cotton was obtained from Diamond Spring, Va., containing a quantity of lint that was brilliant carmine red. Examination showed that this was due to the presence of a fungus, which was identified by Dr. H. W. Wollenweber, of the Office of Cotton and Truck Disease and Sugar-Plant Investigations, as belonging to the genus Fusarium. The fungus was very evident, completely investing the cotton fibers and even penetrating their internal cavities. It was in fruit, and the sickle-shaped compound spores of this genus were abundant.

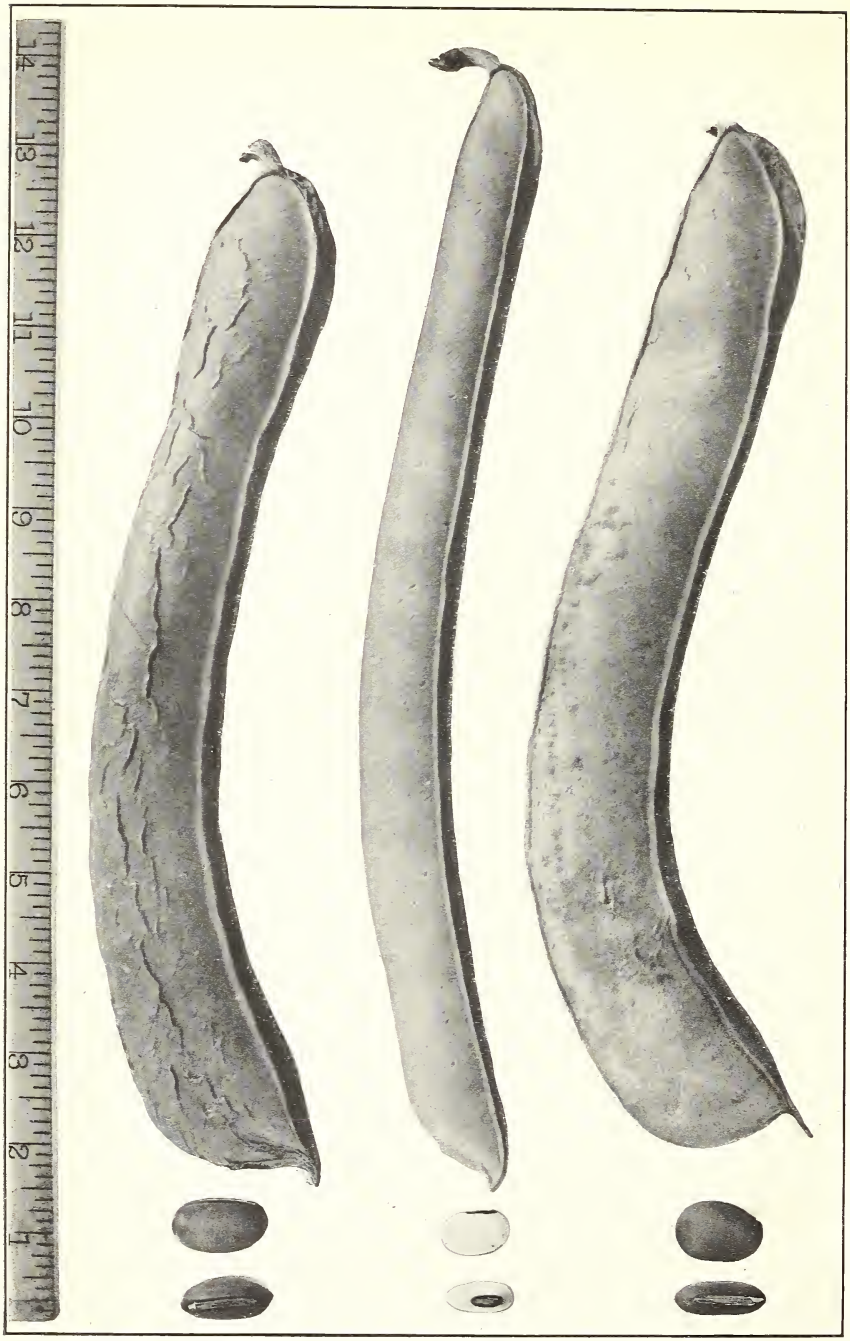
A Fusarium grows upon various host plants in the United States, including the cotton plant, which under alkaline conditions may have either a strong carmine-red or an intense violet-purple pigmentation. It is *Fusarium metachroum* App. and Wr. Unlike some blue and red pigments in plants, the two colors are not convertible into each

[1] Issued Jan. 18, 1913.

other by the alternate action of alkaline and acid reagents, though both result in a yellow color under acid modification.

This agrees so closely with the facts observed in the colored fibers of the cotton cloth that it seems probable these colored fibers are caused by growths of fungi, and probably of the species mentioned, occurring upon cotton exposed to excessive dampness in the field or picked in an unripe condition. The reason the fungus was not discovered on the manufactured fibers is probably due to the mechanical and chemical processes through which it passed. The samples of cloth submitted had been mercerized. The external hyphæ of the fungus would probably be removed in the various processes of ginning, spinning, and subsequent treatment. The absence of hyphæ within the fibers may have been because of no penetration having taken place in the specimens examined, or possibly because of some obliterating effect of the process of mercerizing the cloth.

The manufacturers are now preparing to adopt some means of eliminating these undesirable samples of cotton from the raw material.



PODS AND SEEDS OF THE JACK BEAN AND THE SWORD BEAN.

Central figure, pod of a jack bean (S. P. I. No. 21609) from Brazil. Right-hand figure, a pod of a sword bean (S. P. I. No. 27676) from India. Left-hand figure, pod of a sword bean (S. P. I. No. 27704) from China.

THE JACK BEAN AND THE SWORD BEAN.[1]

By C. V. Piper, *Agrostologist in Charge of Forage-Crop Investigations.*

THE JACK BEAN.

During the past few years the jack bean (*Canavali ensiformis*) has attracted a good deal of attention in Texas and other Southern States. Many inquiries have been received concerning its agricultural value, as under ordinary conditions it grows vigorously and produces large yields of beans.

DESCRIPTION.

The jack bean is a bushy, semierect annual plant, growing to a height of 2 to 4 feet. Its stems are rather coarse and become woody toward the base. The rather thickish leaves have a decidedly bitter taste. The flowers are purple, at least in all varieties so far introduced. The first blossoms are borne near the base of the stem, so that many of the pods hang low. When mature the pods are hard and firm, 9 to 14 inches long, each containing 10 to 14 seeds. These are pure white, with a brown hilum. Ordinarily the roots are well tubercled, and the plant will withstand much drought. It is remarkably free from insects and fungous diseases and but slightly affected by root-knot. (Pl. III.)

HISTORY.

The jack bean is a native of the West Indies and the adjacent mainland. In Jamaica, whence it first became well known, it is called the horse bean or the overlook bean. The horse bean of Europe is a very different plant. In Antigua it has been called the Babricou bean, and in this country has been designated the Pearson bean, and recently the wonder bean.

Owing to confusion with the similar species cultivated in Japan, China, and India, it has also been called the sword bean and the knife bean, but those names properly belong to the Asiatic species.

The first published description of the plant is by Clusius [2] in 1605, whose figures of the pods and seeds received from Brazil are unmis-

[1] Issued Jan. 18, 1913.

[2] Clusius, Carolus. Exoticorum, p. 69, 1605.

takable. Clusius, however, describes the seeds as brownish, but all subsequent authors state that the seeds are white, which is the case in all that have been grown in this country. Sloane [1] gives a good figure and description of the plant in 1707 under the name "horse bean," as he found it in Jamaica. He writes further:

> They are eaten as other Phaseoli by some and counted good food, though their greatest use is to fatten hogs.

Fifty years later Browne wrote of the horse bean as follows:

> This plant grows in many gardens in Jamaica, where it is cultivated chiefly out of curiosity. It seems to keep a main between the upright and the climbing species of Phaseolus, for the stem seldom rises above 3 or 4 feet, though it emits some slender delicate shoots that run much further. The pods are commonly between 10 and 14 inches in length and generally contain 10 or 11 seeds, but the pulse is very seldom used, being generally thought more or less of a deleterious nature.[2]

Macfadyen, writing in the Flora of Jamaica in 1837, records as follows:

> Sloane considers this species to be indigenous to the island and says the seeds were in his time used by some as food and given to fatten hogs. I do not find, however, on inquiry that any use is made at present of them, except that they are commonly planted by the negroes along the margin of their provision grounds from a superstitious notion, probably of African origin, that the overlook fulfills the part of a watchman and, from some dreaded power ascribed to it, protects the provisions from plunder. Even the better informed adopt the practice, though they themselves may not place confidence in any particular influence this humble plant can exercise, either in preventing theft or in punishing it when committed.[3]

The same idea prevails at the present day in Panama.

BOTANICAL RELATIONSHIPS.

The jack bean was briefly described and named *Dolichos ensiformis* by Linnæus.[4] His description is based primarily on the previous account and illustration of Sloane. In later descriptions, however, Linnæus also included under his species various plants described by other authors. In 1759 he redescribes his *Dolichos ensiformis*,[5] citing as its basis the plate and description of an Amboyna plant.[6] Linnæus describes the plant as twining, which accords with the descriptions of both Sloane and of Rumphius. In 1763 Linnæus [7] again describes the plant under the same name, but states that the plant is erect. Besides the plants of Sloane and of Rumphius he includes the Indian plant described and illustrated by Rheede.[8]

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[1] Sloane, Sir Hans, bart. A Voyage to thé Islands Madera, Barbados, Nieves, S. Christophers, and Jamaica, with the Natural History, v. 1, p. 177, 1707.

[2] Browne, Patrick. Civil and Natural History of Jamaica, p. 291, 1879.

[3] Macfadyen, James. Flora of Jamaica, p. 292, 1837.

[4] Linnæus, Carolus. Species Plantarum, t. 2, p. 725, 1753.

[5] Linnæus, Carolus. Systema Naturæ, ed. 10, t. 2, pt. 2, p. 1162, 1759.

[6] Rumphius, G. E. Herbarium Amboinense, pars 5, pl. 142, 1747.

[7] Linnæus, Carolus. Species Plantarum, ed. 2, t. 2, p. 1022, 1763.

[8] Rheede tot Draakenstein, H. A. van. Hortus Malabaricus, pars 8, pl. 44, 1688.

Finally in 1767 Linnæus [1] gives two separate descriptions of *Dolichos ensiformis,* in one of which the plant is said to be erect, in the other twining. Whether this was an editorial blunder or whether Linnæus considered the two distinct and inadvertently used the same specific name twice is open to question. Jacquin evidently thought that the same name covered two species, as the twining one agreed with a plant growing in his greenhouse at Vienna which he had obtained from the West Indies. He redescribed and figured it as *Dolichos acinaciformis.*[2] There can be scarcely a question, however, that these two names include but a single species. It is true Sloane records the plant as twining. Brown says it is suberect, while Macfadyen writes "at first suberect, afterward twining." Two varieties were grown at Biloxi, Miss., and Gainesville, Fla., in 1911 and 1912, one early, the other later and larger. The former is suberect and bushy, while the latter has longer, viny branches. Under favorable conditions it would not be surprising for these plants to assume a vining habit, as a similar phenomenon is well known in the case of bush cowpeas and soy beans.

The plant of Rheede is a distinct species, *Canavali gladiata,* and that of Rumphius is probably the same, but with a faulty figure. Later authors have also confused this East Indian plant with the West Indian, so that it is often difficult to determine which species is referred to.

The genus Canavali founded by Adanson [3] has received general recognition, and the jack bean is therefore properly known as *Canavali ensiformis* (L.) DC. Later authors have usually modified the generic name to Canavalia.

ECONOMIC VALUE.

In the last 20 years the jack bean has several times attracted attention on account of its vigorous growth and large yield of pods and seeds. It was extensively tested at the Mississippi Agricultural Experiment Station during the years 1890 to 1895. Under field conditions yields of 30 to 40 bushels of beans per acre were obtained, even when grown on thin soil. Attempts were made to utilize these beans as feed for both beef and dairy cattle,[4] but the beans were found to be both unpalatable and indigestible.

Three of the lots fed with bean meal made a smaller gain than did many of the lots receiving cottonseed meal, and the best of the bean-meal lots, No. 4a, gained only 3.4 pounds more than did the poorest of the lots receiving cottonseed meal. It should be noted that the lots receiving bean meal were also fed cottonseed meal amounting to

[1] Linnæus, Carolus. Systema Naturæ, ed. 12, t. 2, p. 482–483, 1767.

[2] Jacquin, N. J. von. Collectanea, t. 1, p. 114, 1786.

[3] Adanson, Michel. Familles des Plantes, pt. 2, p. 325, 1763.

[4] Lloyd, E. R., and Moore, J. S. Feeding for beef. Mississippi Agricultural Experiment Station, Bulletin 39, p. 162–163, 1896.

about one-third of their grain ration, and a large part of their small gain should doubtless be credited to the cottonseed meal and not to the bean meal.

The complete failure to secure profitable results from the use of the bean meal was a surprise and disappointment. Various methods of feeding were tried, both coarse and fine meal being used, and during a portion of the time the meal was cooked until it was thoroughly softened. At first very few of the steers would eat any of the meal, but were finally induced to do so by mixing it with salt and cottonseed meal, so that when the trial feedings began all ate it fairly well, though not with much apparent relish. The meal which was eaten appeared to be very indigestible for all the animals, and the same was found to be the case when it was fed to milch cows, as will be shown in another bulletin, soon to be published.

When tried on the table of one of our station staff, the beans were of fair quality, though rather coarse, and no one of the six persons who ate them experienced any ill effect from them.

If the different feeds are considered with reference to only single ingredients of the several rations, the average gains per steer were as follows:

	Pounds.		Pounds.
Shredded corn and silage	35.1	Red-clover hay	71.7
Crab-grass hay	51.5	Cottonseed meal	62.0
Pea-vine hay	60.2	Bean meal	28.4

Seeds of the bean were distributed by Mr. P. Pearson, of Starkville, Miss., from which fact it became known as the Pearson bean. At the Texas Agricultural Experiment Station it produced 35 bushels per acre.[1] At the North Carolina Agricultural Experiment Station it produced an estimated yield of 40 bushels per acre.[2] It was also tested at the Louisiana Experiment Station.[3] None of these stations regarded the bean as promising, but, so far as recorded, no attempt was made to utilize either the herbage or the seeds as forage.

More recently the plant has been tested in Hawaii, and favorable reports as to its forage value have been published.[4]

While grown to some extent in the Southern States, the plant does not appear to thrive as well there as here, and no extensive feeding experiments are reported. The bean meal is said not to be very palatable or digestible for cattle, but this may be due to a too-limited experience in its use. The early feeding experiments with the green fodder in Hawaii gave similar results to those reported above, but as feeders gained in experience the fodder was found to be both palatable and nutritious for dairy cows as well as swine. As with most new feeds, it is important to use in the beginning only a small proportion of the new feed in the accustomed ration and then increase the proportion gradually. The Dowsett and Pond dairies have fed green jack beans and sorghum in equal proportions to dairy cows with excellent results.

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[1] Connell, J. H., and Clayton, James. Field experiments at McKinney, Wichita Falls, and College station with wheat, corn, cotton, grasses, and manures. Texas Agricultural Experiment Station, Bulletin 34, p. 584, 1895.

[2] McCarthy, Gerald. Some new forage, fiber, and other useful plants. North Carolina Agricultural Experiment Station, Bulletin 133, p. 343, 1896.

[3] Dodson, W. R., and Stubbs, W. C. Grasses, clovers, forage, and economic crops. Louisiana Agricultural Experiment Station, Bulletin 53, p. 42, 1898.

[4] Krauss, F. G. Leguminous crops for Hawaii. Hawaii Agricultural Experiment Station, Bulletin 23, p. 19–21, 1911.

The crop requires about a month longer to mature than do cowpeas, but the yield is proportionately greater. Yields of 16 to over 20 tons of green fodder per acre have been reported from various sources. The best yield of seed reported is 1,200 pounds per acre. While a single crop is usually grown from each sowing, the station has occasionally grown a good rattoon crop. Such crops, however, are subject to a leaf blight common to the bean family. Otherwise the crop is exceptionally free from diseases and insect pests, a point greatly in its favor over the cowpea. Another possible advantage possessed by the jack bean over the rambling legumes is the absence of trailing stems, which might interfere in some forms of intercropping.

While the crop is quite drought resisting, as was shown in the excellent yield produced at Kunia during the dry season of 1909, it responds well to irrigation and makes a good growth during the wet season if the weather is not too cold. The jack bean develops a strong root system. The roots are nearly always well supplied with the nodules produced by the nitrogen-fixing bacteria, so that the stubble remaining after the crop is harvested should prove beneficial to the soil. The best method for the culture of the crop, whether it is to be used for green fodder or seed, is to plant in rows and cultivate freely throughout the growing season. For the largest amount of green matter, plant the seed 3 to 6 inches apart in rows 2 to 3 feet apart. If seed is the object, especially if wanted for planting, the rows should be at least a foot farther apart and the seed planted 6 to 10 inches apart in the row. Forty to sixty pounds of seed will be required to plant an acre. The optimum amount of moisture for seed growing is about two-thirds that required for maximum fodder production.

In Porto Rico the jack bean has been found very useful as a green-manure and cover crop in citrus groves. Judging from the behavior of the plant in experimental trials in Florida, it should prove equally valuable there. Its bushy habit makes it especially desirable, as it does not interfere by climbing the trees, while its dense, vigorous growth shades the ground during the heat of summer and provides abundant vegetable matter to add to the soil.

The value of the plant as forage is yet problematical. Its successful utilization as green feed in Hawaii encourages the belief that it may be found equally valuable in this country, especially in Texas and Oklahoma, where its great drought resistance gives it particular promise.

The large yield of seed per acre justifies further experiments to determine whether any means can be devised to utilize the seeds profitably as feed, which the work referred to of the Mississippi Agricultural Experiment Station indicates is a difficult problem. The jack bean has recently been introduced into Java, where on account of the large yield of seed the agricultural authorities were endeavoring to find a market for the product in Europe.

There is also the probability that the jack bean may prove to be valuable as ensilage. Its coarse habit and heavy tonnage should adapt it well to this purpose.

TABLE I.—*Analyses of the jack bean.*

Material.	Water.	Protein.	Fat.	Nitrogen-free extract.	Crude fiber.	Ash.	Publication.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	
Seeds	0	26.85	2.99	56.90	39.90	3.38	Miss. Exp. Sta. Ann. Rep. 8, p. 43, 1895.
Hulls	0	2.44	.52	48.51	43.89	4.64	Do.
Whole pods with seeds.	0	17.76	3.06	65.08	19.31	3.79	Do.
Bean meal	11.48	23.75	2.65	50.37	8.75	3.00	Miss. Exp. Sta. Bul. 39, p. 159, 1896.
Green plant	76.81	5.21	.48	8.44	6.36	2.70	Hawaii Exp. Sta. Bul. 23, p. 31, 1911.

THE SWORD BEAN.

The sword bean (*Canavali gladiata*), also known as the knife bean and the saber bean, is closely related to the jack bean and the two have been much confused. The sword bean is found cultivated through much of southern Asia and also in Africa. At various times it has been introduced into America, but is still cultivated almost entirely as a curiosity or as an arbor vine.

HISTORY.

The sword bean was briefly described and well illustrated by Rheede [1] under the name "Bara-mareca," the plants being found at Angiecamal and other places on the southwest coast of India as a cultivated vegetable. The color of the beans and seeds is not stated. What is quite certainly the same species is described and figured by Rumphius [2] under the name *Lobus machaeroides*, the native name in Amboyna being Cacara parrang. The figure of the pods is, however, faulty. Rumphius describes the seeds as either intense red or else fuscous and states it is rarely cultivated in Amboyna but abundantly in Java and Baleya. Linnæus erroneously supposed the plants of Rheede and of Rumphius to be the same as his *Dolichos ensiformis*, the jack bean. Jacquin, however, grew the sword bean in the greenhouse of the botanical garden at Vienna and in 1788 described it fully under the name *Dolichos gladiatus*,[3] later publishing a beautiful colored plate.[4] The variety he grew had dark-red seeds and white flowers, which later became suffused with pink. The source of the plant is not stated.

Later authors have greatly confused *Canavali gladiata* and *Canavali ensiformis*, but both the pods and seeds of the two are very

[1] Rheede tot Draakenstein, H. A. van. Hortus Malabaricus, pars 8, p. 85, pl. 44, 1688.
[2] Rumphius, G. E. Herbarium Amboinense, pars 5, p. 376, 1747.
[3] Jacquin, N. J. von. Collectanea, t. 2, p. 276, 1788.
[4] Jacquin, N. J. von. Icones Plantarum Rariorum, v. 3, pl. 560, 1786–1793.

different (Pl. III). According to Roxburgh four varieties of the sword bean are found in India, one having red seeds and red flowers, a second with red seeds and white flowers, a third with white seeds and white flowers, and a fourth with light-gray seeds and red flowers. Three of these varieties are now introduced into the United States. All of them are supposed by most Indian botanists to be derived from a brown-seeded wild plant, *Canavali virosa*, the seeds of which are reputed poisonous. Macfadyen reports the variety with red flowers and red seeds as cultivated in Jamaica in 1837. This variety does not fully mature as far north as Washington, D. C., but does produce an abundance of green pods in late September and early October. It seems well worthy of attention as a vegetable throughout the Southern States.

ECONOMIC VALUE.

The sword bean is commonly cultivated as a vegetable in Japan, India, Burma, Ceylon, Java, Mauritius, and apparently in Africa. In India it is eaten both by the natives and by Europeans, the variety with white seeds being most esteemed. The young pods are prepared after the manner of snap beans and are well flavored and wholesome. Firminger considers it "about the nicest of all the native vegetables" in India. The very young pods have but little flavor, but when half grown their taste suggests mushrooms. They are best when about half grown, as the full-sized green pods are rather fibrous. The mature seeds do not seem to be much used as food, though they lack the strong odor of those of the jack bean.

An extended account of the sword bean as grown in Mauritius has been published by Boname,[1] but under the erroneous name *Canavali ensiformis*. This author highly recommends the green pods as a vegetable and gives analyses showing the composition not only of the entire plant but of the beans and pods, both green and ripe.

In China and Japan occur two varieties of the sword bean which differ from those of India in that the pods are thicker and the seeds much plumper and distinctly keeled on the back (Pl. III). This form was described by Thunberg[2] as *Dolichos incurvus* and by Petit-Thouars as *Canavali incurva*. The Japanese name is Nata mame and the Chinese Tau tou. One variety has the seeds cream colored, another pink. In Japan "the young pods of the former are preserved in salt, and the latter is eaten fresh and boiled."[3] Rev. E. R. Miller, of Morioka, Japan, in sending a sample of seed (S. P. I. No. 6132) writes "This as a string bean eaten when very young is one of

[1] Boname, P. The sword bean. L'Agriculture Pratique des Pays Chauds, ann. 10, sem. 2, p. 371, 1910.
[2] Thunberg, K. P. Flora Japonica, p. 280, 1784.
[3] Agricultural Society of Japan. Useful Plants of Japan, [v. 1], p. 9, 1895.

the finest I ever tasted. * * * The Japanese use them generally for pickling when young and they are very fine for this purpose." In China the pink-seeded form (S. P. I. No. 23216) is said by Mr. Frank N. Meyer to be "a very rare bean used mainly as a stomach-strengthening food, and for this reason to be had only in medicine shops." Brill, under S. P. I. No. 6570, also records that these "beans are very good but expensive." As the plant yields heavily, it is difficult to understand why the beans should be expensive.

VALUE FOR FORAGE AND AS A COVER CROP.

All the varieties of the sword bean tested are rambling vines, none of them being bushy like the jack bean. As forage they are not as desirable, as the foliage is just as bitter and the habit inferior.

As a cover crop the Indian variety with red seeds and red flowers has proved very satisfactory in Porto Rico. Cattle are said to graze on the plant there to a limited extent.

The sword bean is not infrequently seen in the South, grown as an arbor plant, but little seems to be known of the value of the green pods as a vegetable. Indeed, the impression prevails that the seeds are deleterious, an idea doubtless obtained by association with the very similar jack bean, as the sword bean is everywhere utilized as a vegetable in the Orient. The plant will develop full-grown green pods as far north as Washington, D. C., but ordinarily the season is not long enough for the seeds to ripen.

FIBER FROM DIFFERENT PICKINGS OF EGYPTIAN COTTON.[1]

By Thomas H. Kearney, *Physiologist in Charge of Alkali and Drought Resistant Plant Investigations.*

INTRODUCTION.

Two pickings were made from the individual selections of the Yuma variety of cotton at Sacaton, Ariz., in 1911, the first early in October, the second about a month later. The first picking consisted largely of the first bolls which open on the plants, these being borne principally on the lower fruiting branches of the main stem. The development of these lower bolls is frequently checked by the heavy shading to which the lower part of the plant is subject in this variety. Practically all of the bolls included in the first picking had matured and opened during the hot weather in September. The second, or November, picking took in the cotton from bolls which were more favorably situated on the plants (nearer the tops) and which had matured during the cooler weather of October.

At Bard, Cal., in 1911, the first cotton in the progeny rows of the Yuma variety ripened so early that these rows were picked in bulk about the middle of September, before individual selections had been made, thus eliminating the cotton which was included in the first individual picking at Sacaton—that from the early-opening bolls near the bases of the plants. For this reason, it would be expected that the cotton of the two pickings made from the individual selections would show less difference at Bard [2] than at Sacaton. A comparison of the fiber from the two pickings of each individual plant at Sacaton and at Bard, respectively, proved that this was the case. No differences in length, strength, and abundance (lint index) of fiber, or in weight of seeds, could be detected in samples from the two pickings at Bard. The conclusions herein reached are therefore based solely upon the material collected at Sacaton.

[1] Issued Jan. 18, 1913.

[2] At Bard the first picking of individual selections was made about October 15, the second at the end of November.

COMPARISON OF THE DIFFERENT PICKINGS.

LENGTH OF STAPLE.

In 33 out of the total number of 60 individual selections made at Sacaton, careful measurement and comparison of the length of staple in the first and in the second picking, respectively, were made.[1] The fiber from the second picking of these 33 plants averaged one-sixteenth of an inch longer than that from the first picking. The uniformity of length was also greater in the second picking. In 42 selections in which the variation in length was recorded, it averaged three-sixteenths of an inch in the first picking and two-sixteenths of an inch in the second picking. In 30 of these plants the variation was greater in the first picking, in 6 plants it was greater in the second picking, and in the remaining plants it was the same in both pickings.

STRENGTH OF FIBER.

In 44 individual selections in which the first and second pickings were compared in respect to strength, 27 showed a greater strength of fiber in the second picking than in the first, 13 showed no marked difference between the two pickings, and only 4 showed stronger fiber in the first picking.

LINT INDEX.

The fiber was decidedly more abundant in the second picking than in the first, the average lint index (weight in grams of fiber per 100 seeds) in the 60 individual selections having been 4.90 for the first picking and 5.17 for the second picking.

FINENESS OF FIBER.

It has been observed every year during which breeding work with Egyptian cotton has been carried on in the Southwest that the fiber from the bolls which open first is often coarser and harsher to the touch than the fiber produced in bolls higher on the plant, which ripen later under the influence of more equable temperatures.

WEIGHT OF SEEDS.

The average weight of 100 seeds in the 44 individual selections in which the two pickings were compared in this respect was 12.9 grams for the first picking and 13.4 grams for the second picking, indicating that the seeds produced in the bolls which ripen earliest are decidedly lighter than those in later ripening bolls borne higher on the plant.

[1] The measurement of length in each of the two pickings was made as follows: From the sample of seed cotton representing each picking from a given individual plant, 10 seeds were drawn at random from different portions of the mass. A cluster of fibers from near the middle of each seed was pulled out and the average length of these fibers was estimated. The mean of the average lengths of the fiber from the 10 different seeds was taken as representing the length of staple for the picking in question.

FUZZINESS OF SEEDS.

There was some indication that the seeds from the first picking had a tendency to develop a rather larger quantity of fuzz on the seed coat than was the case in the second picking, but it is by no means certain that any noteworthy or constant difference in this respect exists.

CONCLUSIONS.

It is clear from the foregoing that the earliest ripening bolls (chiefly those near the base of the plant), which open while extremely high temperatures still prevail, are likely to contain less abundant, shorter, weaker, coarser, and less uniform fiber than bolls which ripen later. The cotton from the earliest picking is also likely to contain more dust and "trash," since the bolls which produce it are closer to the ground and since the leaves and bracts around them have often dried up and become very brittle before the picking is made. For these reasons it would seem advisable, in order to maintain the highest possible standard for Egyptian cotton grown in the Southwest, to make the first picking as early as the number of open bolls will warrant the expense of the operation and to sell the fiber from this picking as a separate grade, not allowing it to become mixed with the bulk of the crop, which may be expected to show decided superiority in grade and quality. It is also probable that the latest cotton to ripen, especially that contained in bolls which open after a severe frost, should also be graded separately. The investigation here described does not, however, throw any light upon this latter point.[1]

Since the bolls which ripen first have often cracked open prematurely under the influence of the high temperatures and extremely dry winds which usually characterize the month of September in the Southwest, the seeds contained in them are frequently not thoroughly mature. This is indicated by their smaller average weight and in fact is evident to the eye from their frequently lighter color. Although no experiments have yet been made to test the point, it is not unlikely that these seeds will be found to give a lower percentage of germination and to produce less vigorous plants than seeds from the second picking. In such cases it would be advisable to use the latter as much as possible for planting.

[1] It is interesting to note in this connection that spinners and buyers to whom samples of the 1910 crop of Arizona-grown Egyptian cotton were submitted found the fiber to be weaker in the sample which represented the fourth picking than in samples which represented earlier pickings from the same fields.